Rewarding Learning

GCE AS A2 Physics Revised
Spring 2010

Chief Examiner's Report

GCE PHYSICS (REVISED)

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Grade Boundaries

Grade	Uniform Mark
Maximum Mark is 300	
A	240
B	210
C	180
D	150
E	120

ASSESSMENT UNIT AS 1 FORCES, ENERGY AND ELECTRICITY

Areas of weakness:

- Detailed knowledge of an experiment to measure the acceleration of freefall.
- Applying the conservation of energy principle quantitatively to more complex situations.
- Quality of diagrams produced by candidates.

Q1 Candidates performed well in this question.

(a) This part was answered very well with most candidates obtaining full marks.

(b) In part (b)(i) some candidates confused sine and cosine and in (ii) it was common for candidates to state, incorrectly, that the forces were equal.

Q2 Some excellent answers to this question were obtained.

(a) Some diagrams were of a very high standard. Generally though, diagrams were untidy and poorly labelled.

(b) A variety of methods were used but descriptions of the method often lacked detail.

(c) Some answers to this part lacked sufficient detail.

Q3 A majority of candidates performed very well in this question.

(a) Almost all candidates obtained the correct answer to part (i). Most candidates calculated the resultant force on the train causing the acceleration but some forgot to add this to the opposing force calculated in (a)(i).

(b) Almost all candidates made the connection between "slippery" and reduced friction. Most then went on to say that the train would speed up. Few candidates appreciated that the friction between the tyres and the track was the driving force and the effect of reducing that would be to slow down the train.

Q4 This question was generally well answered.

(a) A common mistake in this part was to answer generally and not indicate that the force was due to the diver's weight (or mass).

(b) In part (b)(i) the majority of candidates were able to obtain the maximum moment. In (ii), there were a number of candidates who correctly worked out the distance between diver and pivot but were confused by, or ignored, the instruction to quote the distance the pivot be moved from the central position.

Q5 Candidates demonstrated a number of difficulties with this question.

(a) Very well answered.

(b) In part (b)(i) some attempted a solution using equations of uniformly accelerated motion, often with little success owing to the difficulty in accommodating 15% energy dissipation. A number of candidates worked with 15% of the energy rather than 85%. In part (ii) few candidates were able to navigate their way to the correct answer but were able to pick up some marks.

Q6 This question was answered well by a majority of candidates.

(a) Almost all candidates obtained this mark although very few amended their GCSE definition to accommodate their knowledge of the limit of proportionality.

(b) Almost all candidates obtained full credit here.

(c) In part I(i) many candidates introduced a 'power of ten' error when not converting extension in centimetre to metre. Many candidates lost a second mark by failing to obtain a value for k from at least three sets of data. Part I(ii) was well known but a large number of candidates didn't make it clear what was plotted on what axis.

Q7 This question was generally well answered.

(a) In part (a)(i) most candidates correctly stated the base units of the newton but few were able to do so for the volt. In (a)(ii) few candidates referred to their answer to (a)(i) and lost this mark.

(b) In part (b)(i) some candidates wrote a definition of the volt rather than of P.D. In part (b)(ii) the majority of candidates demonstrated their familiarity with this concept.

Q8 Candidates performed well in this question.

(a) Few candidates failed to achieve full marks here.

(b) In part (b)(i) most candidates combined the resistors correctly. In part (b)(ii) most candidates correctly identified the ratio but then applied it incorrectly often losing two of the three marks available.

Q9 The performance of candidates in this question was usually good.

(a) Diagrams were usually drawn using standard symbols but were often untidy. Many candidates omitted, from their diagrams, a means of varying the P.D. across the bulb.

(b) Almost all candidates were able to deduce that the resistance is increasing and were able to link that with the increase in filament temperature. However, many candidates were unsure as to what was colliding with what inside the filament.

The new descriptors used for Quality of Written Communication have meant that more candidates are losing one of the two marks available. The majority of candidates demonstrated high levels of writing skill in their response to part (b) and were awarded both marks.

(c) This part was very well answered. Some candidates, incorrectly, found the gradient of the tangent to the curve at 0.5 A.

Q10 Some candidates found parts of this question very challenging.

(a) In part (a)(i) most candidates calculated the correct output voltage. In part (a)(ii) the calculation was again generally well done but many candidates didn't provide the explanation needed for the second mark.

(b) Many candidate demonstrated a poor understanding of the potential divider circuit in their responses to this question.

ASSESSMENT UNIT AS 2 WAVES, PHOTONS AND MEDICAL PHYSICS

Areas of weakness:

- Writing explanations of words and phrases (E.G. "in phase" from Q 1, "interference" from Q 4 and "energy level" from Q9)
- Converting between sound intensity and sound intensity level.

Q1 Candidates performed well in this question.

(a) Almost all candidates correctly stated the amplitude in part (a)(i). In part (a)(ii) many candidates did not convert from milliseconds and so introduced a 10^n error in their value for frequency.

(b) Responses to this question were not good. Of those candidates who realised that the direction of oscillation could not be ascertained from the graph, few were able to write a convincing explanation.

(c) In part (c)(i) many candidates found it difficult to put into words what "in phase" means however, in part (c)(ii) the majority were able to calculate phase difference.

Q2 This question was very successful in allowing candidates to demonstrate their knowledge of this experiment.

(a) Almost all candidates drew and labelled a diagram that received the mark. The standard of the diagrams was generally poor; often being too small and carelessly drawn.

(b) Almost all candidates achieved at least two of the three marks available.

(c) Candidate knowledge of the distances to be measured was excellent.

(d) Candidates demonstrated a very good understanding of the techniques used to obtain a value for the focal length.

The new descriptors used for Quality of Written Communication have meant that more candidates are losing one of the two marks available. The majority of candidates demonstrated high levels of writing skill in their response and were awarded both marks.

Q3 Most candidates performed well in this question.

(a) A sizeable number of candidates erroneously took the incident angle to be 41.4º.

(b) Most candidates were able to calculate the critical angle from the refractive index.

(c) This part was generally well done.

(d) Many candidates showed the refracted ray bending in the wrong direction on exiting the glass block. An error carried forward (ECF) was applied to this diagram from part (a).

Q4 This question was poorly answered.

(a) In part (a)(i) few candidates gave satisfactory explanations of interference. Many used the word "interfere" to explain interference and received no credit. In part (a)(ii) too few candidates realised that implicit in the term "pattern" is interference that can be seen, this should then lead the candidate to the idea of coherence. In part (a)(iii) some candidates did relate a good contrast in the pattern with waves of equal amplitude coming from both sources.

(b) Answers to this part were generally poor. Many candidates attempted to use $\lambda = ay/D$ but few used the information that source separation had halved correctly.

Q5 This question was very poorly answered.

(a) Two main problems were evident here. First, candidates did not know the threshold intensity for humans ($I_0 = 1.0 \times 10^{-12}$ W m^{-2}) and second, manipulation of the equation for sound intensity level was poor.

(b) In part (b)(i) the majority of candidates knew to add 6 Db to their answer in (a) and received the mark. Few candidates were able to calculate the factor by which the intensity had increased. In addition to the points made in part (a), few candidates knew that a 3Db increase in intensity level corresponded to a doubling of the intensity.

Q6 This question, testing a familiar experiment, was not well answered.

(a) Careless responses here prevented many candidates from achieving marks. It was important that the description clearly identified the first position of resonance.

(b) Part (b)(i) was generally well done. Few candidates, in (b)(ii), were able to explain that repeating at other frequencies makes for greater reliability in the value for the speed of sound. In part (b)(iii) many candidates realised that the wavelength would be smaller but then failed to link that to the difficulty in taking a reading.

Q7 Many candidates found this question challenging

(a) Few candidates were able to write good answers to part (a)(i) that stated energy was absorbed and suggested a sensible reason for it. In part (a)(ii), most candidates indicated they knew what to do but many were careless. Some introduced a 10^n error and others didn't account for the ultrasound travelling the bone thickness twice.

(b) In part (b)(i) many candidates wrote answers that completely ignored the focus of this question which was on the techniques employed by A scans and B scans. Part (b)(ii) was generally well answered.

Q8 Candidates responded well to this question.

(a) This question was well answered generally. However, a sizeable number of candidates did not use the term photon in explaining why photoelectrons are given off.

(b) In (b)(i) some very good definitions of work function were given and candidates demonstrated their ability, in (b)(ii), to convert between the electron volt and the joule. Most candidates successfully recalled and used the equation for photon energy in (b)(iii).

Q9 Many candidates exhibited confusion in their responses to this question.

(a) In part (a)(i) many candidates wrote answers that lacked precision. However, most candidates satisfactorily explained the "ground state" in part (a)(ii).

(b) In part (b)(i) many candidates have the misconception that the negative energy levels are due to the negative charge of the electron. In part (b)(ii) many candidates forgot to make the conversion from electron volt to joule.

(c) Few candidates responded in a clear and unambiguous fashion which resulted in a poor mark allocation to this question.

Q10 Many candidates exhibited a lack of detailed knowledge on this section of the course.

(a) This question was generally well answered.

(b) In part (b)(i) most candidates knew the Davisson and Germer experiment but few knew it in sufficient detail to achieve full marks. In part(b)(ii) most candidates described the effect on the interference pattern reasonably well but the accompanying explanations were poor. Few candidates mentioned the de Broglie wavelength.

ASSESSMENT UNIT A2 1 MOMENTUM, THERMAL PHYSICS, CIRCULAR MOTION, OSCILLATIONS AND ATOMIC PHYSICS

Grade Boundaries

Grade	Uniform Mark
A	89
B	78
C	67
D	56
E	44

Q1 This question was very well answered. The conservation of momentum and its simple application appeared to be well known by the candidates. In the main this question served to settle the candidates to their task, and allow them to proceed to give their best efforts in the remainder of the paper. Many candidates scored full marks and very few scored poorly.

(a) It was good to see that nearly all candidates used the correct format kg m s^{-1} for the Si unit of momentum.

(b) A few candidates did not appreciate the vector nature of momentum and had sign errors in their equation.

(c) Some candidates did not explain the collision as inelastic because kinetic energy was not conserved. Candidates could and should have been able to make this deduction without undertaking a calculation.

Q2 This question was not well answered.

(a) In part (a)(i) some candidates gave poor sketches of the apparatus. Labels were not always present but credit was given for the obvious items of apparatus. The heating coil took various forms and sometimes it was placed outside the vessel containing the liquid. Candidates could score full marks for showing six out of a possible nine items of apparatus. A few candidates drew the apparatus for a gas law experiment instead of that required for the specific heat capacity experiment. Part (a)(ii) was poorly answered. Most candidates did not grasp the idea of balancing heat energy gain at the low temperature with a subsequent heat energy loss at the higher temperature. A wide range of incorrect answers were received focusing incorrectly on temperature.

(b) In part (b)(i) the calculation was answered correctly by some candidates but many answers were incorrect and scored only part marks. A common error was to neglect completely the copper container. Another error was to add the mass of the container to the mass of the milk to calculate the heat received. In (b)(ii) many answered correctly that the result in (b)(i) was higher but could not adequately or clearly explain why. A number of candidates merely stated the information given in the question i.e. “there were heat losses” and did not continue to explain the effect or consequences of such losses.

Q3 This question was well answered.

(a) About half the candidates could not define angular velocity.

(b) The graph for angular velocity against time produced many incorrect shapes other than the correct horizontal line.

(c) All the parts of this question were answered correctly by many candidates. An error carried forward (ECF) marking instruction helped others to score well. Part (c)(iii) produced some odd answers e.g. "clockwise", or "about a point".

Q4 This question obtained good and bad answers.

(a) Parts (a)(i) and (ii) appeared to discriminate well between candidates of differing abilities. Other candidates were not able to state x as the displacement from a centre point, or the significance of the negative sign. Some gave correct but inappropriate statements e.g. "the acceleration is maximum when the velocity is zero".

(b) Parts (b)(i) and (ii) also appeared to discriminate well between candidates of differing abilities. In (b)(i) odd values appeared for A and ω but some of these candidates could still gain marks by drawing the correct graph in (b)(ii). The most common error in b(ii) was to omit the units on the axes and sometimes also not to start at the maximum positive displacement point. In b(iii) many candidates did not state draw a tangent to the curve first, and then measure its gradient to obtain the velocity. Some complex impractical methods were stated e.g. differentiating the curve and calculating the velocity. Part (b)(iv) produced correct answers by the better candidates but all had difficulty in clearly defining the position of the mass relative to the negative magnitude of the calculated displacement.

Q5 This question obtained reasonable answers.

(a) Candidates obtained mostly 2 or 3 marks and were helped by the half mark for each component and round up procedure.

(b) Usually 1 mark was scored for the operation i.e. producing light flashes from the fluorescent screen but most candidates did not appreciate the function was to detect alpha particles after they had been scattered by the gold foil.

(c) This part was answered well by good candidates. Some poor answers were given e.g. "there was lots of space between the atoms". In I(ii) some candidates could give sensible answers but never mentioned the required term "nucleus"

Q6 This question was not well answered by many candidates.

(a) In part (a)(i) incorrect definitions of half-life were often stated e.g. "the time for half the mass to be lost" or "half the atoms to disappear". Activity or number of nuclei were seldom mentioned by many candidates. In (a)(ii) the opportunity to obtain the number of nuclei of X and Y using the half-life to halve the numbers present as required was missed by many candidates. On other occasions candidates have been very eager to use half-life when it was not at all appropriate. Some candidates succeeded completely and others obtained part marks for determining the number of X or Y nuclei after the specified time.

(b) In (b)(i) very many candidates could not obtain the number of nuclei in 1.5 mg of polonium. Hence the correct activity could not be calculated. However, ECF helped a number of candidates to obtain marks in (b)(ii). The best candidates could answer the both parts correctly.

Q7 This question drew some good and bad answers.

The question was an attempt to stretch and challenge candidates by providing them with an opportunity to express their knowledge in a constructive manner with only limited direction. Some succeeded well, where others did not.

The appropriate graph was binding energy per nucleon (BE/n) against nucleon number (A). Many incorrect graphs gave binding energy against a variety of quantities but had the general shape of the correct graph. Some candidates knew the correct magnitudes for the graph scales, and the regions concerned with fission and fusion, others did not.

Some discussions given were very good, others were very weak. In discussing fission and fusion (often confused) it is good practice to use the correct terminology. This was a distinct weakness in many answers when the following terms particles, molecules, elements, and atoms were used instead of the correct term nucleus or nuclei. Some candidates had a tendency to make repetitive statements.

Q8 Many candidates found this question challenging.

(a) In part (a)(i) many answers omitted the required important details for nuclear fusion. Fusion was sometimes confused with fission and the correct terms light and heavy nuclei were frequently replaced by small and large atoms or particles respectively. Some candidates also omitted to combine two nuclei. Candidates in part (a)(ii) did not often score two marks. General statements were given as the answer without focusing on why the D -T reaction would be better than others for terrestrial fusion. Only two possible reasons were required from five acceptable answer responses. Frequently none were given.

(b) The constituents of a plasma did not appear to be well known. Sometimes the conditions to produce a plasma were given as the answer e.g. “high temperatures and high pressures or high speeds.”

(c) Many candidates restated the question as the answer e.g. "a plasma confined by a magnet". The idea of a magnetic field exerting a force on the charges in a plasma to hold or form it in a particular way was rarely stated. The function not to contact any container walls which would cool it and thus terminate a possible fusion reaction was missed by the majority of candidates. Vaporise or melt the walls was given credit.

(d) This calculation was correctly answered by many candidates. Some candidates introduced substitution errors when using the correct equation to calculate the (estimated) temperature of the plasma, part marks were awarded in this instance.

Q9 This question received reasonable answers. Some candidates did appear to be short of time and did not complete this question. With a little care and applying basic skills (graph drawing and formula evaluation) it was quite straightforward to score half marks in this the highest value question (14 marks) on the paper.

(a) In part (a) a common incorrect answer was 2.25 to 2.34 where candidates had used the third significant figure instead of the possible values of the fourth to obtain the possible range of values for the output E.

(b) This part was well answered by nearly all candidates. Most could draw a suitable curve through the points although this would have been an uncommon type of graph exercise for them.

(c) In part (c)(i) the majority of candidates did not appreciate that the unit for B when multiplied by the temperature squared had to result in mV hence (mV $°C^{-2}$). In part (c)(ii) most candidates could correctly substitute into the given formula and show the output at 200° to be 10.8 mV. In part (c)(iii) nearly all drew the straight line accurately. Some candidates drew a line to an incorrectly plotted point, or a line which was not continuous e.g. two lines joined together. Incorrect lines were accepted for evaluation of errors in the latter parts of the question.

(d) In part (d)(i) very few candidates indicated the exact error to be negative. In part (d)(ii) point accuracy evaluated consistent to (d)(i) was given full credit without penalty for an incorrect sign. The majority of candidates in (d)(iii) indicated the temperature to be above the correct temperature. Credit was allowed for answers consistent with incorrectly drawn graphs.

(e) This part received only a few correct answers. Candidates did not comprehend it would take the thermocouple longer to stabilise to any temperature. The point accuracy would remain the same but the response time would increase. Either of these points would have been acceptable, very rarely was either given.